LETTERS TO THE EDITOR.

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Ascent of Sap.

PROF. VINES, in his interesting address to the Botanical Section of the British Association, has referred to the problem of the ascent of sap.

We believe Prof. Vines is under a mistake when he states: "Now as to the force by which the transpiration-current is raised from the roots to the topmost leaf of a lofty tree. From the point of view that the water travels in the substance of the walls the necessary force need not be great, and would be amply provided by the transpiration of the leaves, inasmuch as the weight of the water raised would be supported by the force of imbibition of the walls. From the point of view that the water travels in the lumina, the force required to raise and support such long columns of water must be considerable." If we gather the sense aright, this statement involves perpetual motion, as may be seen by imagining both cell-walls and lumina filled with water. According to Prof. Vines, water may be obtained from the cell-walls in the higher parts of the plant with the exertion of a less force than from the lumina. If now we establish a connection, the lumina will draw from the cell-walls, and with a second connection below, an endless circulation will arise. The error arises from supposing that water can be withdrawn from the cell-walls and maintained in upward motion without opposition from the entire gravitational pull. Or, stating the matter in another way, the force which is assumed to uphold the water will also act to resist its withdrawal from the walls. Indeed the withdrawal of water from the cell-walls must be necessarily attended by much higher frictional resistance than would obtain if the supply were received from the lumina. The same objection may, in our opinion, be urged against any exposition of the "imbibition" theory. The underlying fallacy is, in fact, essentially the same as that on which the theory of capillarity and gas-pressure is founded, and which Prof. Vines rejects as "quite inadequate."

Prof. Vines, in further discussing the question, speaks of a tensile force of 360 lbs. to the square inch as being required to bring the sap to the summit of a tree 120 feet high, and states that, not only is there no evidence for the existence of such a force, but that it is even negatived by the indications of the experiments of Hales and Boehm. Without discussing the validity of the supposition that such a force is anywhere required (beyond stating, as our opinion, that the grounds upon which this estimate has been obtained are very doubtful), we would certainly like to know to which of the experiments of Hales and Boehm Prof. Vines refers. So far as we are aware, the indications of Hales' and Boehm's experiments were of necessity limited by the difficulty of putting the water (external to the branches experimented upon) into a condition capable of bearing tension. These investigators, however, did not clearly understand this point. The experiments made by us in the same direction certainly all failed from this cause. The most, then, that can be admitted is that direct observation has never revealed the full state of tension of the sap of a transpiring tree, although, as in the case of some of Boehm's experiments, indications of the existence of tension were conclusively obtained. This is a very different thing from assuming that negative indications have been experimentally obtained. It is hard to see why Prof. Vines should consider the existence of a transpiration force of 20 atmospheres as improbable. It has, indeed, been shown by experiment that the turgescence of the cells of the leaves of many trees is capable of exerting a tractional force of over 20 atmospheres on the water in the conduits.

Prof. Vines dismisses the tension theory as offering no solution to the problem. But how does the matter stand? The more important points may be stated in a very few words.

In the theory of the tensile sap we find full reason for the subdivided structure of the water-conduits and for the structure of their lignified cell-walls (especially as seen in the ingenious mechanism of the bordered pit); stability is conferred on a liquid in tension and liable to the evolution of gas-bubbles by the first, and a minimum of resistance with safety against rupture is secured to the wall by the second. To raise the water through this system the turgescence of the leaf-cells is fully adequate, even were the tension greater than what Prof. Vines demands. Again, in the light of this theory, the advantage of the periodic recurrence of root pressure becomes apparent, as a safeguard against the multiplication of functionless lumina destroying the continuity of the system. On the other hand, those who have discussed this theory have as yet brought to light no fact in vegetable physiology or anatomy opposed to its validity; while many points, *e.g.* the collapse of protoxylem elements, and the occurrence of year-rings, have received in it an explanation.

From the physical point of view, the theory is not only adequate to meet all the requirements of the plant, but the existence of tension in a system of minute chambers having walls at once permeable to water and impermeable to free gas, whether altogether or partially filled with dust-free water, is inevitable. The *onus* of proof does not here lie with the upholders of the tension theory merely because it has come late upon the scene, but its opponents must show how the tensile state is evaded before they can dismiss the existence of the tensile stress in the sap at such times as root-pressure is not the uplifting force.

If, then, the sap is in tension from the nature of the conditions and the leaves active in withdrawing water from above, why deny the adequacy of the explanation?

With regard to the date of publication of our theory, Prof. Vines is slightly in error. Our paper was communicated to the Royal Society in Nov. 1894, and an abstract of it appeared in NATURE in the same month.

HENRY H. DIXON.
Trinity College, Dublin. J. JOLY.

Homochronous Heredity and the Acquisition of Language.

THE question raised by Mr. Stuart-Menteath in NATURE of September 27 (page 524) is one of such general interest to all students of heredity that it is to be hoped that some authoritative expression of opinion will be forthcoming. Even in its present form the query involves the subject of the heredity of acquired characters, and it would be of the greatest importance to have experimental systematic observations carried out if such observations have not already been recorded. So far as my very limited acquaintance with the subject extends, I know of no such experiments. It would be desirable perhaps to widen the scope of the question, and to put it in this form: Take children of different nationalities, say German, French and English; allow them from infancy to hear all three languages indiscriminately. Is there any reason for believing that each child would show a predilection or greater facility for acquiring the language of its country?

R. MELDOLA.
October 8.

Autotomic Curves.

BRITISH mathematicians have usually employed the phrase "non-singular curve" to designate a curve which has no double points. This phrase is an exceedingly infelicitous and misleading one, since a *point of inflexion* is just as much a singularity as a *double point*.

The word *autotomic* (self-cutting) has occurred to me as a suitable one to designate a curve which has double points; but the objection to this word is that the phrase "an anautotomic curve" is somewhat offensive to the ear. In the case of media which are not isotropic, mathematicians have evaded a similar difficulty, which would be caused by the use of the word *anisotropic*, by employing the term *aeolotropic*.

Perhaps some of your readers, who have kept up their classics, may be able to suggest a suitable word to convey the idea of a "not-self-intersecting-curve."

A. B. BASSET.
Fledborough Hall, Holyport, October 5.

THE OPENING OF THE MEDICAL SCHOOLS.

THE subject-matter of the studies comprising the medical curriculum lends itself exceptionally well to the delivering of inaugural addresses. Every October produces its crop of young men and women beginning the study of medicine, and to these are addressed with never-failing regularity an almost constant number of introductory lectures. To those who watch from a distance the perhaps somewhat monotonous rhythm of

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medical academics, it would appear at least probable that these opening addresses, actuated, as they certainly are, by a perpetually similar motive, would be in imminent danger of suffering from a monotony almost approaching boredom. Medicine, however, and its allied sciences are never at rest, and the constant change in them from year to year forms an almost inexhaustible subject-matter at once interesting to the initiated, and stimulating to the novice. The latter learns, as a rule even in his first lecture, that in embracing medicine as his profession he has not to tread a rigid scholastic entity, but to pick a somewhat circuitous way over a plastic science, which is capable and willing to receive the intellectual footprints of all who are strong enough to impress them.

The third Huxley lecture was delivered this year by Lord Lister, and the authorities of Charing Cross Hospital are to congratulated upon having heard one of the most interesting discourses which it will probably ever be their lot to listen to. Although none of us can for any length of time forget the scientific work for which Lord Lister is celebrated, perhaps few of us are cognisant of his early researches, which, indeed, although perhaps to the superficial observer remote from his later work, according to him—and what better authority can we want—led up to it. All those who have the opportunity of reading this address *in extenso* should do so; it forms another of the many instances of how work of a more or less erudite character led up to results most emphatically utilitarian. This should be remembered and taken to heart by those in authority who are apt to look askance at work, whatever it may cost in the way of perseverance or intellectual effort, which is not immediately productive of utilitarian result.

At the relatively new School of Tropical Medicine, Sir W. MacGregor delivered an inaugural address, taking for his subject some problems of tropical medicine. An interesting point in his discourse was the importance he attached to the study of dysentery. According to him, epidemic dysentery is a scourge of tremendous magnitude, carrying off in some cases 50 to 75 per cent. of the labourers upon certain plantations in Polynesia. His concluding remarks were directed to malaria, and he emphasised in this connection the importance of investigating certain equine maladies on the West Coast of Africa, apparently of a malarial type.

At University College an inaugural lecture was delivered by Dr. Vivian Poore upon science and practice. The lecturer addressed himself mainly to those students who were actually beginning the study of medicine as distinct from the so-called elementary medical sciences. He warned his hearers against adopting the view that all that could not be submitted to laboratory methods was *ipso facto* not scientific, and in this connection drew attention to certain discoveries made by physicians by mere observation, which were from the highest standpoint scientific. Many facts, although explained by bacteriological research, had been discovered by physicians by methods which were purely clinical. Dr. Poore finally pointed out the advantages that should accrue to the students at University College Hospital from the reconstruction it was undergoing, and also how the reconstitution of the University of London might be expected to affect the medical lectureships in the metropolis.

King's College Hospital began the medical session by an old students' dinner, at which Sir John Cockburn presided. The speeches which ensued, although limited, were mainly directed to two subjects, the share which has been taken by the staff in the surgical work in South Africa, and the manner in which the school had been improved during the past year by the establishment of largely increased laboratory accommodation and new lectureships, special reference being made to the subject of pharmacology.

At the inaugural dinner at Guy's considerable interest was attached to Mr. Fripp's speech, which dealt with the work done by the Imperial Yeomanry Hospital in South Africa. This hospital had broken a deal of new ground, and many in a position to judge of the organisation and management of hospitals had expressed the hope that from the demonstration which it had been enabled to give of the way that modern scientific methods could be introduced into the service of the sick and wounded in the time of war, reorganisation of military hospitals upon the lines of the large civil institutions might be effected.

The medical session at St. Thomas's was opened by Sir William MacCormac. In the course of his remarks Sir William pointed out that the present time was a favourable one for entering the medical profession, as London was about to have a great university in reality, and not one in name only, and also that the supply of medical men was not keeping pace with the increase in the population, as shown by the list of medical students entered on the rolls of the General Medical Council.

At St. Mary's Hospital the introductory lecture was delivered by Mr. Stansfield Collier upon the future of the medical student. At the London School of Medicine for Women Mr. Aldrich Blake addressed the students. The subject-matter of both these lectures consisted mainly of advice to the student with regard to the mental habits he should cultivate in approaching his work. An interesting lecture was delivered at the Royal Veterinary College by Prof. MacFadyean. According to the lecturer, the century approaching its conclusion embraces practically the whole history of the veterinary profession in Great Britain. One hundred years ago the Royal Veterinary College was only in the tenth year of its existence, and since then great changes had come over veterinary opinions and practice. With regard to the progress that had been made concerning the causes of disease, glanders and tuberculosis were taken as types. As recently as twenty years ago the opinion that tuberculosis was an extremely hereditary disease was universal among veterinary surgeons, and it was only within the last decade that the erroneousness of this view had been generally recognised. Discoveries which threw light on the cause and nature of maladies necessarily influenced methods of treatment and prevention, and the past century had witnessed great changes in the means adopted to counteract disease. As an instance of this, the almost complete extent to which bleeding has become obsolete may be given. Firing and blistering, although still extensively used, were employed now with more discrimination than formerly, and it seemed upon insufficient evidence.

The inaugural address in the medical faculty of the University of Birmingham was delivered by Prof. Windle, who chose for his theme the very appropriate one of the needs, aspirations and ideals of the Birmingham Medical School. Those who have carefully followed the stages in the development of the great Midland University will not have failed to observe that the main spirit which actuated it when it was, so to speak, on paper, and will continue to guide and distinguish it when architects' plans have been replaced by well-equipped laboratories, is the spirit of scientific research. It will be a great centre for teaching students how to prosecute research in all branches of technical industry. The generous manner in which land has been given by Lord Calthorpe and funds have been supplied by the wealthy citizens of Birmingham has secured opportunities for this purpose, which, when the whole is complete, will probably be unrivalled. Such opportunities are certain to attract students, and especially medical students. It is to be hoped that what is being done at Birmingham will stimulate the formation and endowment of laboratories at the London schools, which, if they wish to attract the mass of students they have done in the past,

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will be compelled to offer them advantages at any rate not inferior to those that they can find much nearer home.

The students of the Middlesex Hospital were addressed by Prof. Clifford Allbutt upon abstractions and facts in medicine. His concluding remarks with regard to the value of research laboratories are significant, the lecturer confessing that mere observation of disease and morbid anatomy have taken us almost as far as these means can do. Morbid processes should be tracked in their earliest dynamic initiation in order that they can be arrested in these stages. The clinical laboratory of a county hospital should be the centre of enlightenment to all the private practitioners of the district.

The space at our command has only permitted us to reproduce a relatively small fraction of the many interesting and instructive addresses that were delivered during the course of last week. It is sincerely to be hoped that teachers and students alike have profited by them, and that their united efforts will result in the addition to the profession of a body of workers who will be in the truest sense medical imperialists, and who, while working to the fullest advantage the store of learning they have inherited, will not rest content with it, but extend in all directions the empire of medical knowledge, even up to the threshold of the temple of truth.

F. W. TUNNICLIFFE.

A NIGHT WITH THE GREAT PARIS TELESCOPE.

SINCE the final decision was made some years ago to commemorate the Paris Exhibition of 1900 by the installation of a giant telescope which should surpass in size and power any other then in existence, so many varied and contradictory statements have been quoted in the Press, and even in many scientific journals, that a considerable amount of scepticism has been inherent in the minds of most persons interested in the matter. Much of the inaccuracy is traceable to a rather loose estimate being given of the magnification which it was hoped to employ, it being stated that the moon would be apparently brought so close that any object of 1 square metre area could be distinguished. By the extreme kindness and courtesy of M. François Deloncle, to whose initiative the entire instrument is due, the writer was enabled, not only to thoroughly examine all parts of it during the day, but also to take part in the practical astronomical use to which it is already being put during every clear night. A general view of the siderostat is shown in Fig. 1, and the inclusion of the attendant's figure in the upper balcony will give some idea of its relative size. The masonry foundation is about 5 feet 6 inches high, the extreme height of the curved casting carrying the mechanism at the back being about 34 feet. The circular glass mirror seen between the upright fork in front is 6·5 feet (2 metres) in diameter, and about 11·8 inches (30 centimetres) thick, being silvered on the upper exposed side. When not in use a large glass plate is lowered over the silvered surface by a windlass worked from the gallery. As the glass mirror weighs some 3600 kilogrammes, and the iron cell and forked support about 3100 kilogrammes, the friction on the pivot allowing rotation would have been too great for accurate driving if some provision had not been made for eliminating it. This has been successfully done by immersing the base of the fork casting in a bath of mercury, contained in the circular part of the front half of the main base plate, thereby relieving the pivots of about 9/10ths of the total weight. The rotation of the mirror in a vertical plane is also facilitated by the counterpoise weights shown at the ends of the levers acting on each extremity of the horizontal axis passing through the centre of the mirror.

At the western side of the siderostat, above the handles moving the instrument in right ascension and declination, are two telescopes, which by a system of lenses and mirrors enable the observer to read the divisions on two graduated circles without leaving his position. By his side there is also a standard sidereal clock and a telephone.

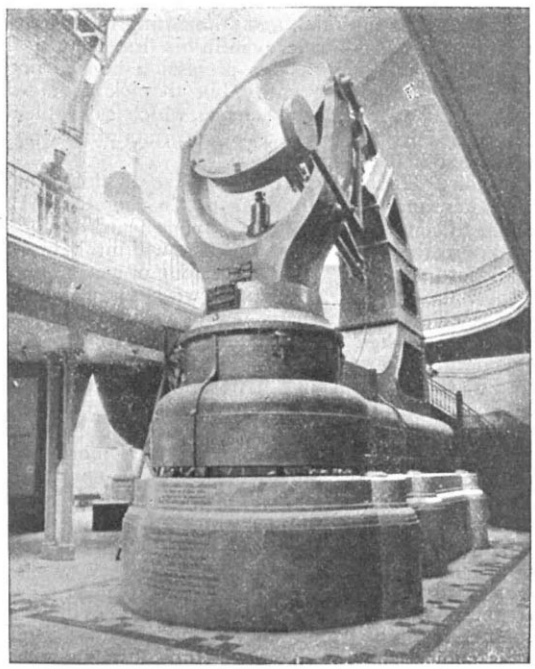

FIG. 1.—The great siderostat, Paris, 1900.

Leaving now the siderostat, and mounting the staircase seen behind it, access is gained to the upper balcony which runs round both sides of the whole length of the building. Fig. 2 is a view taken from the eye-end of the telescope, 200 feet away to the south, and the siderostat

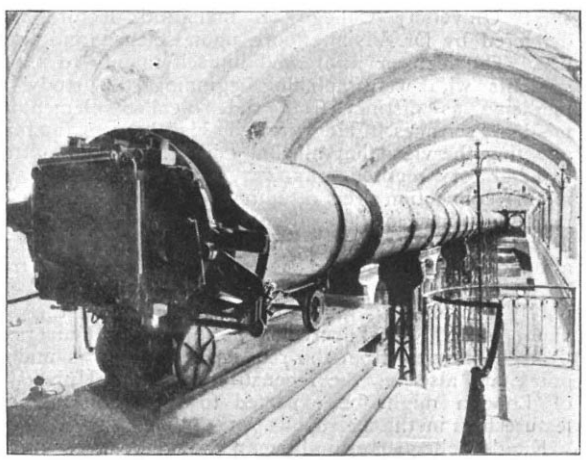

FIG. 2.—Eye-end of the refractor, Paris, 1900.

can just be seen under the arch at the north end. Above, on the gallery, the circular object-glass is clearly shown in its case. Two of these lenses are to be provided, one specially corrected for visual work, the other for photographic purposes. The lens completed and in position is the latter. The carriages for holding these lenses in

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